

THE CERES S'COOL PROJECT

STUDENTS' CLOUD OBSERVATIONS ON-LINE

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(NASA Web Site Privacy Statement)
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CERES Science Team Meeting
Williamsburg, VA
November 2, 2004

What is S'COOL?

- Education and Public Outreach arm of CERES
- A simple way to involve K-12 students in real science
- A source of validation data for the CERES cloud data
- Began in 1997



S'COOL Needs YOU!

- **Participants in every state and 65 countries**
 - Offer to serve as a **resource** to a local teacher
 - Arrange a **S'COOL** visit when traveling
 - Provide **S'COOL** info to teachers you know
- **Presentation materials available**, with script suggestions
- **Help with translation of materials** (especially German and Italian)
- **Serve as resource for scientific content questions sent in by participants**

Impact Measures

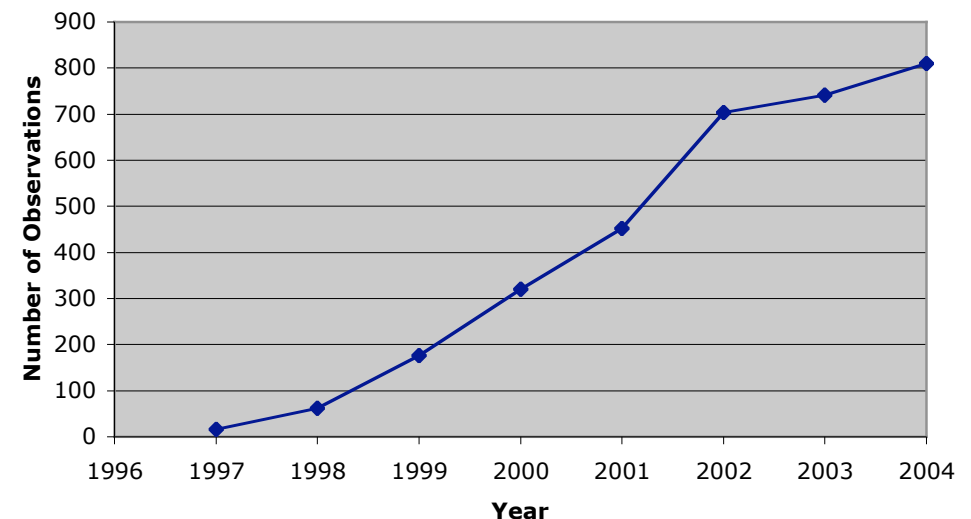
Database of observations - as of 10/28/04

- 36,307 observations
- 1752 registered participants
36% have submitted data
- 65 countries
data from 47 (72%)
- Over 9000
Ground/CERES
T&S Correspondences

Observation “Top Five”

- ♣ United States
- ♣ Croatia
- ♣ Colombia
- ♣ Nicaragua
- ♣ France

Average Observations per Month (1997-2004)



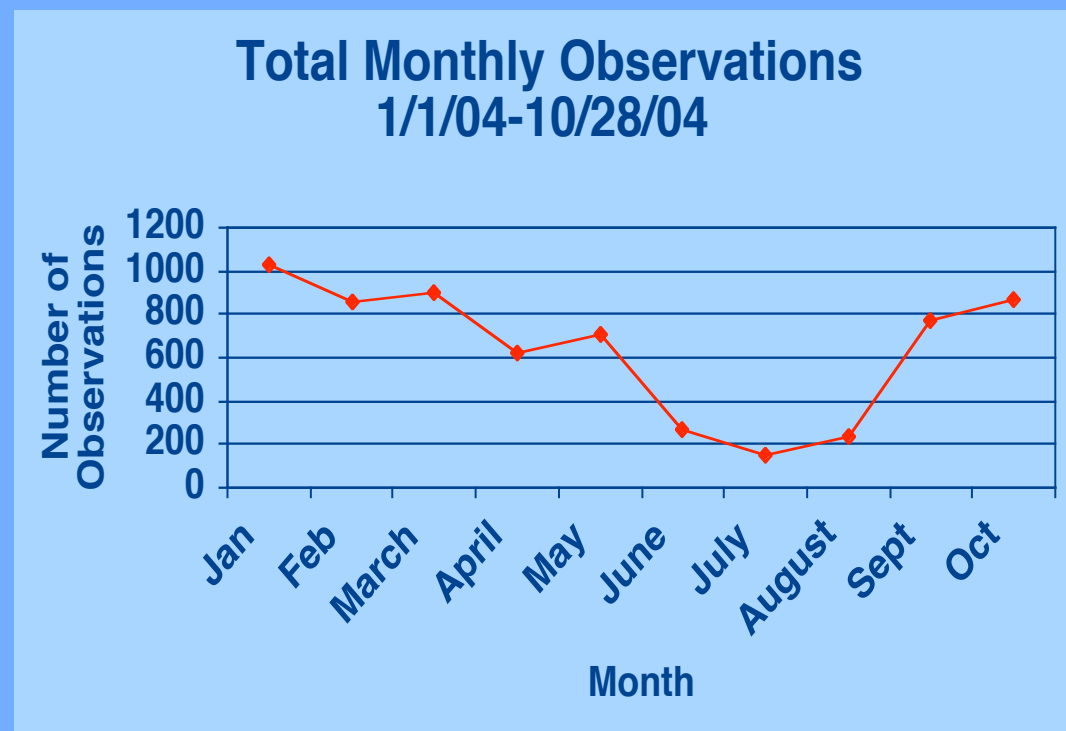
Impact Measures (cont'd)

Cyclic trend in observations

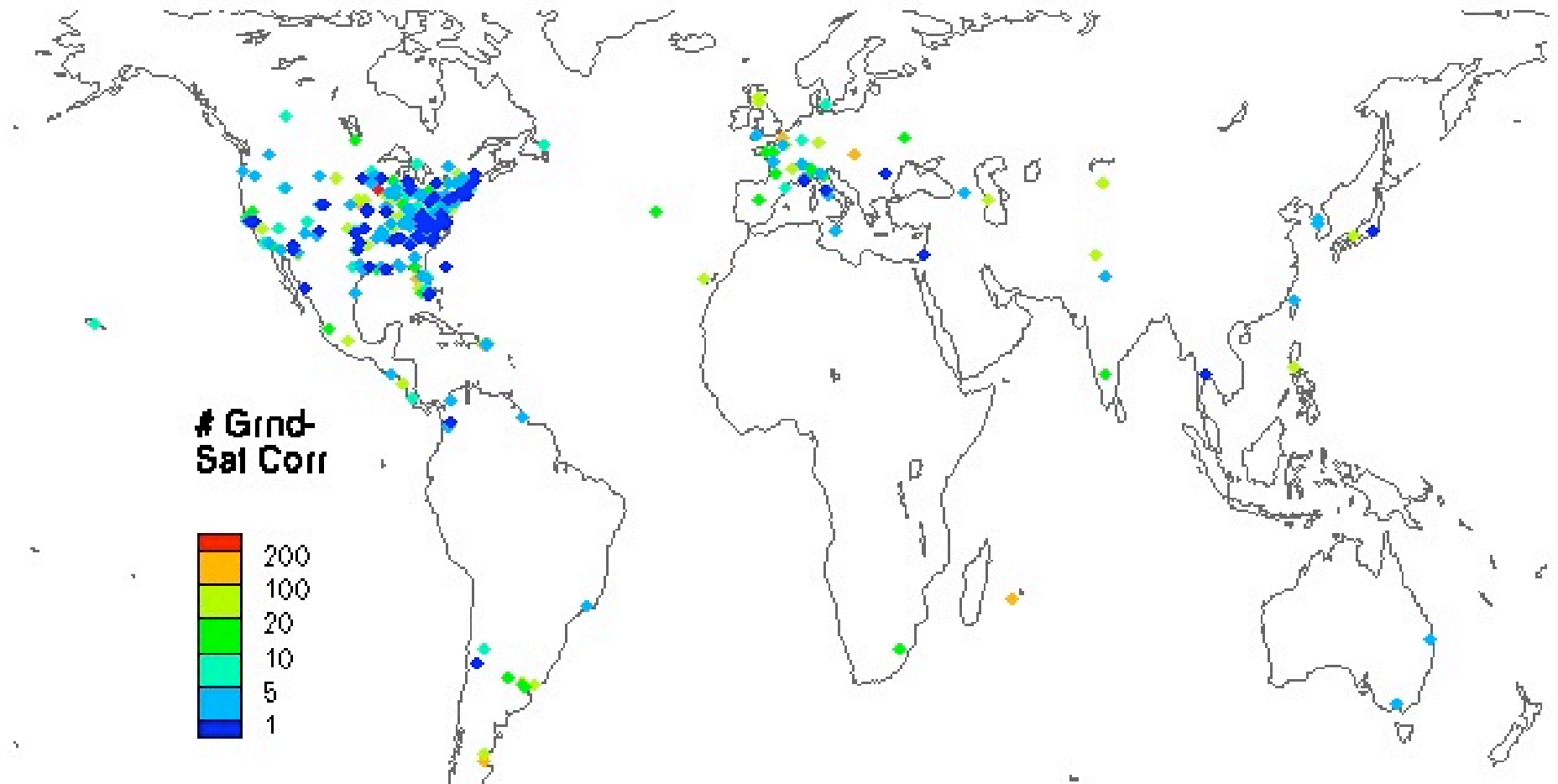
Total number is lower during American schools' "traditional" summer break.

Opportunity

Increased efforts to engage "summer schools", year-round schools, and informal science education groups



Data Available












Max: 479 (High School in Pennsylvania)

Min: 1 (70 schools)

Comparing to Satellite

- S'COOL Site Matched to 1 degree Satellite Region
- Observation Times Within 15 Minutes

School Name	Latitude	Longitude	City	State	Country			
Greensboro Day School	36.20	-79.80	Greensboro	NC	USA			
Surface Information				Satellite Information 239965				
Date: 2002-10-10		Universal Time: 15:54		Date: 2002-10-10				
				Universal Time: 15:53				
Satellite: Terra				Satellite: Terra				
Opacity	Cloud Cover	Type	Visualization		Altitude	Opacity	Cloud Cover	Phase Temp (K)
								
Opaque	(95% to 100%)	Altostratus			7.40	Opaque 28.40	(95% to 100%) 100.00	mixed 253.40
Opaque	(5% to 50%)	Stratus						
								
Persistent Contrails: 00		Short-Lived Contrails: 00						
Surface Observations:	Snow/Ice: No Standing Water: No Muddy: No Dry Ground: Yes Leaves on Trees: Yes							
Temperature: 19.00 C Barometric Pressure: 1024.00 hPa Relative Humidity: 35.00 %								
Comments: submitted by Matthew Fore and Mr. Martin.								

Cloud Amount Comparison

		S'COOL Students			
		Clear	Partly Cloudy	Mostly Cloudy	Overcast
Satellite	Clear	1415	350	101	48
	Partly Cloudy	624	897	575	230
	Mostly Cloudy	193	553	695	680
	Overcast	143	187	489	1992

191 3-class errors (2%) - ~1/3 easily explainable

711 2-class errors (8%) - need more study

3271 1-class errors (36%) - may be near-matches

Students Overcast vs. Satellite Clear (48 cases)

- **Spatial Mismatch?:** $>1/3$ are schools located less than 0.1 degree from the edge of a lat/long grid box.
- **Universal Time?:** 3 cases with incorrect UT
- **Student/Satellite error?:** remaining cases have no clear explanation. Study needed.
- **Snow:** 10 cases, yet the satellite still reports clear sky.

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Students Clear vs. Satellite Overcast (143 cases)

- **Spatial mismatch?:** About 22%
- **Universal Time?:** ~10
- **Snow?:** 18 cases students report snow.
 - Only one satellite retrieval is suspect: low cloud temperature 2.5K below the surface temperature.
- **Satellite/Student error?:** stratus = clear?

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Future Plans for Data Analysis

- Inviting S'COOL participants to do detailed analysis of their correspondences**
- More analysis to be done (2-class and 1-class errors, cloud levels, opacity....)**
- Data available via the Internet for analysis:**

<http://asd-www.larc.nasa.gov/SCOOL/usedata.html>

S'COOL Team Presentations Since March 2004

- **3 Local, regional, state, or national conferences** (Posters, Share-a-Thons, Presentations, Workshops)
- **9 Presentations to student groups** (classroom visits, after-school groups, CHROME)
- **10 Other** (Girl Scouts summer day-camp, Region 2 Educators meeting, Explorer Schools training at LaRC, ESSEA Alliance, Newport News Elementary Science Lead Teachers, YMCA, NASA Explorer Institute for Nat'l Park Rangers, Education , South Carolina Blue Ribbon Schools)

S'COOL Peer-reviewed Papers and Publications

- **AMS Meeting** in Norfolk, VA
- **IGARSS Conference**, Anchorage, AK
- **Science and Children** magazine article by Linda Bryson, S'COOL ambassador
- **NASA Portal Earth Explorers** feature article about S'COOL student- participant, Abigail Hoglund

What's New at S'COOL?

- S'COOL cloud type Tutorial accepted by Earth and Space Science review panel



<http://asd-www.larc.nasa.gov/SCOOOL/tutorial>

- S'COOL Breeze Newsletter sent September 2004 with the next issue December 2004
 - English (1467)
 - French (54)
 - Spanish (207)

Going Through the **Loop** Plans Lesson

Create a Cloud in a Bottle

Objective: Students will use critical thinking skills of analysis and evaluation to determine conditions necessary for the formation of clouds.

Type of Activity: Application/Extension **Suggested Grade Level:** 8-12 (adaptable to other grade levels as teacher demonstration)

Vocabulary: Water Vapor, Condensation, Evaporation, Condensation Nuclei (Aerosol), Fog

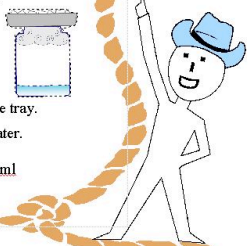
Materials: warm water, aluminum tray, ice, see-through jar, match (aerosol source)

Background: Clouds consist of millions of tiny droplets of water. The droplets form by the condensation of water vapor. Air is cooled as it moves higher in the atmosphere. The cooling of the air prompts the condensation of the water droplets on dust particles. Condensation may also occur near the Earth's surface, resulting in fog. Fog forms when warm air passes over a cooler area, such as a body of water.

Lesson Activity: Here's how to make your own cloud.

1. Fill a jar with 2 inches (5cm) of warm water and stir.
2. Ask an adult to light a match, blow it out and drop it into the jar.
3. When the smoke clears, place an ice-filled aluminum tray on top of the jar.
4. Watch carefully and a cloud will form near the top of the jar just beneath the tray.

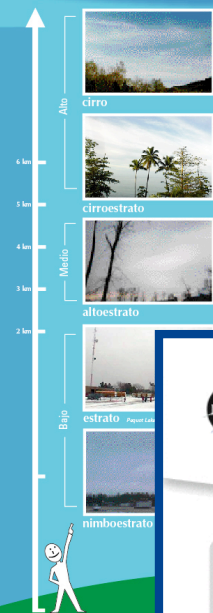
Teacher Notes: Warm tap water typically works well but do not use boiling water.
Complete Lesson Plan available at:
http://asd-www.larc.nasa.gov/SCOOOL/lesson_plans/Create_Cloud_lab.html
Student "Cloud Cookery" available at:
http://asd-www.larc.nasa.gov/SCOOOL/PDF/Cloud_ID_rev.pdf



What's New? (cont'd)

- **S'COOL Observation Award**
- **Links to Chinese and Thai versions of S'COOL website**
- **Italian poster is now available and Spanish poster has entered its second printing**
- **S'COOL One-page flyer**
- **Increase in number of S'COOL ambassadors (S'COOL Summer Workshop alumni serving as S'COOL presenters in their local, regional and state areas)**
- **New Intro Packet**

CARTA DE IDENTIFICACIÓN DE NUBES



LA COCINA DE LAS NUBES

Cómo Hacer una Nube

Algunas veces se ha preguntado: ¿Cómo se forman las nubes? (Esto es bien sencillo! Las nubes se forman de la condensación o congelación del vapor de agua. ¿Quieres verlo por ti mismo? Todas las veces necesitas la supervisión de un adulto y los siguientes artículos caseros:

agua tibia, bandeja de metal, hielo, jara transparente, fieltro.

La condensación ocurre cuando un gas (vapor de agua) se enfría en esta actividad, cambia a líquido (la nube). Cuando el vapor de agua se enfía, se condensa en la superficie. Por ejemplo, en un día cálido tapa afuera una botella de agua fría, notarás que gotitas de agua se forman en la superficie de la botella. Esto es CONDENSACIÓN y las nubes son formadas de la misma manera. Así es como puedes hacer tu propia nube.

Procedimiento:

¿Qué sucedió exactamente?

El agua tibia líquida forma el vapor de agua. Este proceso de cambiar el agua líquida a gas se llama EVAPORACIÓN. El vapor se enfía cuando este sube y se aproxima a la bandeja con hielo. Las partículas de humo, del fieltro, proveen una superficie para que el agua se condense. Se dice suerte que:

¿La evaporación es lo opuesto a la condensación? Si comenzamos la bandeja de metal, la nube se desparece al mezclarse con el agua que rodea al alm. Este mismo evento ocurre en nuestro medio ambiente. El agua evaporada se condensa,



Cloud Identification Chart



CONVECTIVE CLOUDS

SUPPLY & DEMAND NEEDS MET



CARTE D'IDENTIFICATION DE NUAGES



LA RECETTE DU NUAGE

Comment Faire un Nuage

Ne t'es tu jamais demandé comment se forment les nuages? Eh bien c'est assez simple! Les nuages se forment à partir de la condensation ou de la congélation de la vapeur d'eau. Veux tu en faire l'expérience? Tu auras besoin d'un adulte pour t'aider et des produits ménagers suivants: Un frottoir, un plateau en métal, des glaçons, un bocal transparent, une paille. La condensation se produit quand un gaz (vapor d'eau) dans cette activité se liquéfie (le nuage). La vapeur d'eau se condense sur une surface quand elle est refroidie. Par exemple, ammène une bouteille d'eau froide à l'intérieur en jour où il fait chaud et la première remarque que des gouttelettes d'eau se forment sur la surface de la bouteille. C'est ce qu'on appelle la CONDENSATION et les nuages se forment de la même manière.

Alors que s'est-il passé exactement?

L'eau chaude forme de la vapeur d'eau. On appelle ce processus de la transformation d'eau en gaz: EVAPORATION. Alors que la vapeur d'eau monte et s'approche du plateau rempli de glaçons, elle se refroidit. Les particules de fumée provenant des glaçons servent de surface sur laquelle l'eau va se condenser. Avant tu réalises que l'évaporation est le phénomène opposé à la condensation? Si tu retires le plateau en métal, le nuage disparaît en se mélangeant à l'air environnant plus chaud. La même chose peut se produire avec d'autres



CLASSIFICATORE DELLE NUBI



LA RECETTE DU NUAGE

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scie di condensazione

nubi Convettive



THE CLOUD COOKERY

How to Make a Cloud

Have you ever wondered how clouds form? Well it's quite simple! Clouds form from the condensation or freezing of water vapor. Want to see for yourself? You'll need an adult for supervision and the following household items:

warm water, metal tray, ice, see-through jar, match.

Condensation occurs when a gas (water vapor in this activity) changes into a liquid (the cloud). Water vapor condenses onto a surface when cooled. For instance, take a cold water bottle outside on a warm day, and notice that water droplets form on the surface. This is CONDENSATION and clouds form the same way. Here's how to make your own cloud.

- Procedure:**
1. Fill a jar with 2 inches (5cm) of warm water and stir.
 2. Ask an adult to light a match, blow it out and drop it into the jar.
 3. When the smoke, clears place an ice-filled metal tray on top.
 4. Watch carefully and a cloud will form near the top of the jar.

So what exactly happens?

The warm liquid water forms water vapor. This process of changing liquid water to gas is called EVAPORATION. As the water vapor rises and nears the ice-filled tray the vapor cools. The smoke particles provide a surface for the water to condense. Did you realize that evaporation is the opposite of condensation? If you remove the metal tray, the cloud will disappear as it mixes with the warmer surrounding air. The same events occur in our environment. Evaporated water condenses to form clouds which may later produce rain. The production of rain is referred to as PRECIPITATION. Together, EVAPORATION, CONDENSATION and PRECIPITATION play an important role in the WATER CYCLE.



EVER WONDER HOW CLOUDS GOT THEIR NAMES? WELL YOU MAY BE SURPRISED TO FIND OUT!

In 1803 Luke Howard used Latin terms to classify four main cloud types. Cumulus means pile and describes heaped, lumpy clouds. Cirrus, meaning hair, describes high level clouds that look wispy, like locks of hair. Featureless clouds that form sheets are called Stratus, meaning layer. The term Nimbus, which means cloud, refers to low, grey rain clouds. Alto is used to describe mid level clouds. Finally, convective clouds have a vertical development extending through large portions of the atmosphere.

Cloud Cover

of the amount of one by estimating the percentage of the sky with clouds.

provide a clue.

New S'COOL Outreach Strategies

- **Alaska outreach**
 - E-mail sent to 55 school divisions (end of September)
Response rate 30%, still receiving
 - Ambassador, Carol Clark, presented at Alaska State Science and Mathematics Conference (mid-October)
 - AK registrations have increased from 6 to 10 since since September 28
- **States with successful ambassadors: AK, OR, NY**
- **Additional states targeted for ambassadors: NM, PA, GA, IN, WV, WA**

Education Outreach

Soaring to New Heights

